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Structure of Texas Vegetation

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REVIEWS

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In his studies on the structure of the vegetation of eastern Texas, Tharp has recently made a notable contribution to plant ecology. That unexplored vegetation has always had an irresistible attraction for botanists is well exemplified in the résumé of studies of Texas vegetation. An adequate review of the earlier work is given. This work began even before the colonists declared their independence from Mexico. It includes the studies of Lindheimer, who was both a geographer and collector; deals with the numerous papers along broad ecological lines by Bray; and traces the studies to the recent analysis of the vegetation in connection with the Red River boundary dispute.

The territory studied embraces all of Texas east of the 98th meridian. This is an area of 80,000 square miles with a wide variation in topography, climate, geology, and soils, and includes parts of four plant formations and their broad ecotones. In altitude it reaches from the gulf coastal marshes to 1,000 feet in the northwest extremity, much of it consisting of rolling hills. The southeastwardly flowing streams, as transporters of disseminules and because of the richness of their flood plains and the supply of water afforded by them, exert " a tremendous influence upon the physiognomy of the vegetation." Precipitation in this semitropical to temperate climate varies from 50 to 30 inches, precipitation decreasing and temperature extremes becoming more rigorous northwestward. The various geological formations from Recent and Pleistocene more or less parallel the coast in narrow strips extending to the Comanchean-Cretaceous in the northwest. Within each geologic formation there are various types of soil but " geologists, colleagues of mine, are unanimous in the opinion that geologic structure may usually be determined by the physiognomy of the vegetation it supports."

The four plant formations, each represented by a single association, together with associes and the broad ecotones, are delimited on a map, thus making the groupings of the various units infinitely easier to visualize. Dominance in the Southern Evergreen Forest Formation belongs in the main to *Pinus palustris* but is shared to a slight extent towards the margins by *P. taeda* (southward) and *P. echinata* (northward). This formation covers, in eastern Texas, about 8,000 square miles of poor, sandy soils underlaid with clay. It has contacts on the south with the coastal prairie and on the north and west with the oak-hickory forest. Transition to both is through the pine-oak ecotone.

[1] Tharp, B. C. Structure of Texas vegetation east of the 98th meridian. University of Texas Bulletin No. 2606, pp. 100, Pl. 30, 1926.

In the treatment of each formation considerable attention is given to societies, the development of the hydrosere and of secondary successions. This is followed by analytical lists of species—dominants, societies, socies, clans, seral trees, etc.—thus giving in general a clear picture of vegetation and its sequence of development. " Forest fires never reach the catastrophic destruction in the southern pine region which they reach in the North and West." Victims of fire in Texas pine forests are principally seedlings and young saplings as well as old trees which, as a result of injury, have exuded resin. Lumbering methods give rise to tremendous fire hazards. Repeated fires are followed by the invasion of grasses—species of *Andropogon, Aristida,* etc.—which have ultimately to compete with shrubs and stunted trees, many of which (sweet gum, postoak, blackjack, wax myrtle) formed " the subjugated population " of the climax forest floor.

The Pine-Oak Association forms a broad ecotone between the pine and the oak forests. It extends from the Red River on the north to the coastal prairie bordering the gulf and encircles the pine forest on the west and northwest covering an area of 14,500 square miles. The dominants are *Pinus echinata, P. taeda, Quercus stellata, Q. marylandica, Q. rubra,* and *Liquidambar styraciflua.*

Further north and west the Deciduous Forest Formation (*Quercus-Carya* Association) is found. It covers nearly as much area as the pine-oak forest ecotone. Dominance is exerted by *Quercus stellata, Q. marylandica,* and *Carya buckleyi* (including var. *arkansana*). It forms a long narrow strip, nowhere more than 60 miles wide, which extends northward to the Red River and fringes that stream far westward. From this western portion long arms extend southward into the prairie which borders the woodland on the west. The deciduous woodland soil is uniformly of sand underlain with clay. The surface is of rolling hills. These are " the most constant of all the physical features of the area, and the well-known coarseness and porosity of such soils suggest corollary water relations as the controlling factor in its geographic distribution. No critical study has as yet been possible, however, to determine the extent of its control; and it is here suggested upon purely inferential and presumptive evidence." The soil of the forest, while not excessively rich, is superior to that of the pine-oak ecotone. Precipitation varies from 30 to 45 inches.

The Grassland Formation is represented by the *Andropogon-Stipa* association. Unlike the Deciduous Forest which forms a broad belt west of the coastal prairie in the south (although with occasional local areas of *Andropogon-Stipa*) and gradually narrows northeastward, the Grassland enters the area from the southwest as a strip less than 20 miles wide but gradually broadens northward until in the vicinity of the Red River it has a width of more than 150 miles. Like the Deciduous Forest it is discussed but briefly. The soils are without exception black clay derived from decomposed limestone. Outcrops of sandy or gravelly red clay soils occur which are invariably occupied by oak forest. The fine textured and humus filled soils overlying limestone hold effectively the water afforded by the 30 to 50 inches of precipitation. Because of agriculture and grazing, railroad right-of-ways offer the best specimens of climax vegetation. Dominant grasses are *Andropogon saccharoides laguroides, A. scoparius, A. furcatus,* and *Stipa leucotricha,* all of which range throughout the area. *Agropyron smithii, Koeleria cristata,* and *Triodia pilosa* are co-dominants in the northern portion. Successions in fallow land, the effects of overgrazing and the establishment of *Bulbilis,* and woody invaders in prairie are briefly discussed.

The Coastal Prairie (*Bulbilis-Andropogon-Sporobolus* Associes) occupies an area of approximately 10,000 square miles lying between the southern limit of the climax associations and the coastal marsh. The whole area, including the marsh,is very low and flat, and consequently poorly drained. The soil is mainly alluvium. Species of *Panicum* and *Paspalum* are especially prominent and are mixed with *Aristida, Bulbilis, Eragrostis,* and *Andropogon* in the west. In the east, where precipitation is greater, *Bulbilis* is replaced by *Sporobolus berteroanus.* Much of the vegetation is apparently still in a developmental stage, and the dominants of the climax (*i.e., Andropogon* and *Bulbilis*) do not yet actually control the area to any considerable extent. The Coastal Marsh (*Spartina-Sporobolus* Associes) is characterized by numerous grasses (*Spartina spartinae, Sporobolus virginicus, Rynchospora* spp.) and by *Scirpus, Typha, Phragmites,* and *Arundo donax.* Beach vegetation is also listed.

The Oak-Cedar-Mesquite Woodland (*Quercus-Juniperus-Prosopis* Association), belonging properly to the flora of western Texas, enters this region and is briefly characterized.

The work has been done on this extensive area on broad ecological lines "instruments for laying out and plotting analytic quadrats and photographic apparatus constituting the principal working paraphernalia." The four maps and 52 halftones are excellent, and, even with brief descriptions of the vegetation, the carefully arranged lists of species give a rather clear insight into the structure of the vegetation. With the almost universal use of Clements classification of vegetation,[2] it no longer seems necessary to devote space (as does Tharp) to a restatement of its principles. The writer shows much ability to express clearly and succinctly the salient points of the structure of the diverse plant communities of this extensive and somewhat complex vegetational area.

Considering the large territory embraced in this investigation, measurements of the environmental factors by instruments and phytometers, quantitative evidence on developmental sequences, and a detailed analysis of the requirements of the dominants in their competitive environments, are not to

[2] Tansley, A. G., and Chipp, T. F. Aims and methods in the study of vegetation. P. viii. London, 1926.

be expected. But it is to be hoped that these may follow as a natural sequence to this general vegetational study.

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